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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/587,216	05/29/2007	Junfeng Geng	011765-0356172	4818

909 7590 09/11/2009  
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EXAMINER
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PENNY, TABATHA L

ART UNIT	PAPER NUMBER
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4171

MAIL DATE	DELIVERY MODE
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09/11/2009

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/587,216	<b>Applicant(s)</b> GENG ET AL.	
	<b>Examiner</b> TABATHA PENNY	<b>Art Unit</b> 4171	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 25 July 2006.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-14 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-14 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 25 July 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>11/14/2006, 10/25/2006</u> .                                  | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Claim Rejections - 35 USC § 112***

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. MPEP 2164.01 establishes the analysis required to determine whether the filed disclosure contains sufficient information regarding the subject matter of the claims as to one skilled in the art to make and use the claimed invention without undue experimentation. The factors to be considered to determine whether any necessary experimentation is undue, also known as The Wand factors, see *In re Wands*, 858 F. 2d 737, 8 USPQ2d 1400, 1404 (Fed. Cir. 1988) include, but are not limited to:

- (A) The breadth of the claims;
- (B) The nature of the invention;
- (C) The state of the prior art;
- (D) The level of one of ordinary skill;
- (E) The level of predictability in the art;
- (F) The amount of direction provided by the inventor;
- (G) The existence of working examples; and
- (H) The quantity of experimentation needed to make or use the invention based on the content of the disclosure.

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3. Claim 5 rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for decomposition of a carbon-containing metal salt under an inert gas atmosphere, does not reasonably provide enablement for the decomposition of an organometallic compound under an inert gas atmosphere. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make the invention commensurate in scope with these claims. After analyzing the application with the above factors, the examiner concluded that there is no enabling disclosure of the use of an organometallic compound as the nanoparticle precursor. The specification states that an organometallic compound can be used in place of a carbon-containing metal salt but the manner in which it should be used is not clear. Claim 5 is directed to the decomposition of a carbon-containing metal salt or organometallic compound in an inert gas atmosphere. The applicant discloses direction and working examples on producing a nanoparticle from a carbon-containing metal salt precursor. These embodiments include decomposition of the carbon-containing metal salt by heating in an inert gas atmosphere; however, no direction or working examples of an organometallic compound are disclosed. Applicant has not disclosed embodiments or direction utilizing an organometallic compound as the nanoparticle precursor and undue experimentation is needed to make or use the invention based on the content of the disclosure.

***Claim Rejections - 35 USC § 102***

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

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A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-14 are rejected under 35 U.S.C. 102(b) as being anticipated by HOU *et al.* ("Carbon Nanotubes and Spheres Produced by Modified Ferrocene Pyrolysis," Chemistry of Materials, American Chemical Society, p. 3990-3994, (2002)).
3. **Regarding applicants' claim 1 and 14**, HOU *et al.* teaches a method of producing carbon encapsulated metal nanoparticles (HOU abstract) comprising: providing an organometallic compound, ferrocene, into a reactor, quartz tube, and decomposing the organometallic compound while maintaining carbon in the reactor, vaporized anthracene (HOU Experimental Section, "CNT Synthesis"), to form a carbon-encapsulated metal nanoparticle (HOU Abstract)
4. **Regarding applicants' claim 2**, HOU *et al.* discloses a reactor vessel with a restricted opening (HOU figure 1).
5. **Regarding applicants' claim 3**, HOU *et al.* discloses a quartz tube having one sealed end and one end with a restricted opening (HOU figure 1 and Experimental Section, "CNT Synthesis").
6. **Regarding applicants' claim 4**, according to applicants' disclosure, unidirectional gas flow is prohibited by directing gas flow towards the restricted opening of the reactor. HOU *et al.* discloses a method wherein unidirectional gas flow across the reaction site is prevented (HOU figure 1).

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7. **Regarding applicants' claims 5 and 6**, HOU *et al.* discloses the reaction being accomplished under an argon atmosphere (HOU figure 1 and Experimental Section, "CNT Synthesis").

8. **Regarding applicants' claims 7 and 8**, the claims are rejected in view of HOU *et al.* because although they further limit the decomposition of the carbon-containing metal salt, they do not require the selection of the carbon-containing metal salt instead of the organometallic compound. Further, HOU *et al.* teaches decomposition of the organometallic compound by heating at temperatures of 700°C and 1000-1100°C.

9. **Regarding applicants' claims 9, 10, and 11**, HOU *et al.* discloses ferrocene,  $\text{Fe}(\text{C}_5\text{H}_5)_2$ , as the organometallic compound.

***Claim Rejections - 35 USC § 103***

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

11. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

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12. Claims 12-13 are rejected under 35 USC 103(a) as being obvious over HOU *et al.* in view of XU *et al.* ("A novel technique by the citrate pyrolysis for preparation of iron oxide nanoparticles," Materials Science and Engineering, B77, p. 207-209 (2000)).

13. **Regarding applicants' claims 12 and 13**, HOU *et al.* discloses a method of producing carbon encapsulated metal nanoparticles (HOU abstract) comprising: providing ferrocene, an organometallic compound, into a quartz tube, reactor, and decomposing the ferrocene while maintaining carbon in the reactor (HOU Experimental Section, "CNT Synthesis"). HOU *et al.* does not appear to explicitly disclose a carboxylic acid metal salt, such as a metal citrate or stearate, as the pyrolysis precursor for the carbon encapsulated metal nanoparticles; however, XU *et al.* discloses a technique of pyrolysis of iron citrate, in air, to prepare iron oxide (XU Experimental). XU *et al.* also discloses that citric acid easily complexes with a number of metal ions (XU Introduction). At the time of the invention, it would have been prima facie obvious to one of ordinary skill in the art to use the carboxylic acid metal salt pyrolysis precursor, taught by XU *et al.*, as the organometallic compound pyrolysis precursor of HOU *et al.*, in order to easily obtain the required metal-carbon complex.

### **Conclusion**

14. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. RANA *et al.* ("Preparation, Texture, and Magnetic Properties of Carbon Nanotubes/Nanoparticles Doped with Cobalt," J. Phys. Chem., ed., American Chemical Society, p. 4079-4084, (2002)); RANA *et al.* ("Carbon Nanoflask: A Mechanistic Elucidation of Its Formation," J. Phys. Chem., American Chemical Society,

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p. 9769-9776, (2002)); SANO ("Separated synthesis of iron-included carbon nanocapsules and nanotubes by pyrolysis of ferrocene in pure hydrogen," CARBON, Elsevier Science B.V., p. 2159-2179, (2003)); and LEE *et al.* ("Excellent magnetic properties of fullerene encapsulated ferromagnetic nanoclusters," Journal of Magnetism and Magnetic Materials, Elsevier Science B.B., p. 404-411 (2002)) all disclose a similar method for manufacturing carbon encapsulated metal nanoparticles.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to TABATHA PENNY whose telephone number is (571)270-5512. The examiner can normally be reached on Monday thru Friday 8:00am-4:30pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Barbara Gilliam can be reached on (571)272-1330. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



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